Comparison of Spinel Phase $LiMn_2O_4$ Prepared by Different Methods of Synthesis for Li-ion Battery

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$LiMn_2O_4$ spinel has been extensively studied for Li ion batteries as a promising cathode material. The spinel has advantages such as a high cell voltage, low cost, and environmental friendliness. However, poor cycling performance is a drawback of the spinel[1-4].

It has been shown that particle size and morphology influence the electrochemical performance of the cathode material[5]. In order to obtain proper physicochemical properties of the cathode materials for Li ion batteries, several synthesis methods have been studied.

$LiMn_2O_4$ spinel powder was synthesized by a traditional solid state reaction method and the supercritical water synthesis (SCWS) method[6,7]. Compared to the solid-state reaction method, SCWS method using the rapid expansion of supercritical water offers several advantages such as narrow and small particle size distribution for synthesis of crystalline oxide materials.

The spinels powders synthesized by both methods were characterized by X-Ray powder diffraction (XRD) to identify the spinel structure. Intrinsic electrochemical behavior of the materials was investigated by cyclic voltammetry and constant current charge/discharge using 2016 coin cells. Diffusion coefficients were also measured by Galvanostatic Intermittent Titration Technique (GITT) to investigate the difference of the kinetic parameters between the both materials.

Figure 1 shows the XRD patterns of $LiMn_{2-x}O_4$ powder synthesized by solid-state reaction. All the main diffraction peaks of the sample could be indexed to a single spinel structure ($LiMn_2O_4$) having a space group Fd3m in which the lithium ions occupy the tetrahedral (8a) sites and Mn^{3+}, Mn^{4+} and the doping metal ions reside at the octahedral (16d) sites.

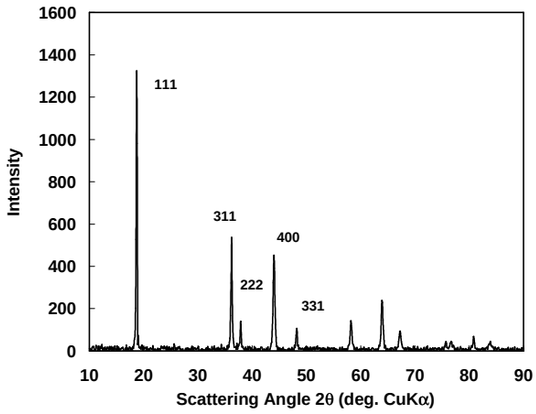

Figure 1: X-ray diffraction patterns of spinel $LiMn_2O_4$ by Solid-State reaction

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